AD-A106 634 BLACK AND VEATCH KANSAS CITY MO F/G 13/13
NATIONAL DAM SAFETY PROGRAM. NONAME 791 (COVES LAKE) DAM (MO 10--ETC(U)
AUG 78 P R ZAMAN, B A AINSWORTH, H L CALLAHAN DACW43-78-C-0148
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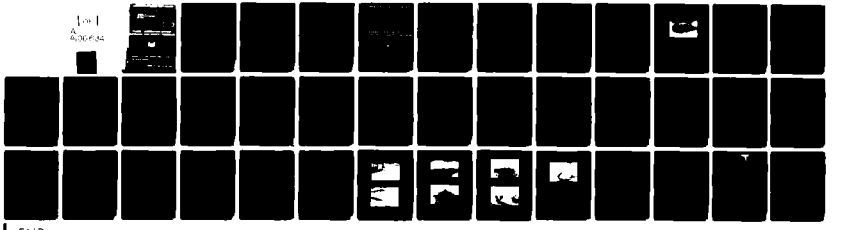

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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MISSOURI-KANSAS CITY BASIN

NONAME 791
PLATTE COUNTY,MISSOURI
MO 10929

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

AUGUST 1978

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: No Name 791 (Coves Lake) Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the No Name 791 (Coves Lake) Dam. It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: SIGNED
Chief, Engineering Division

2 FEB 1979
Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer

2 FEB 1979
Date

NO NAME 791 DAM
(COVES LAKE DAM)

PLATTE COUNTY, MISSOURI

MISSOURI INVENTORY NO. 10929

PHASE I INSPECTION

NATIONAL DAM SAFETY PROGRAM

PREPARED BY:

BLACK & VEATCH
CONSULTING ENGINEERS
KANSAS CITY, MISSOURI

UNDER DIRECTION OF

ST. LOUIS DISTRICT CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

AUGUST 1978

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam	No Name 791 (Coves Lake) Dam
State Located	Missouri
County Located	Platte County
Stream	Tributary to Line Creek
Date of Inspection	31 August 1978

No Name 791 (Coves Lake) Dam was inspected by a team of engineers from Black & Veatch, Consulting Engineers for the St. Louis District, Corps of Engineers. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers. Based on these guidelines, this dam is classified as a small size dam with a high downstream hazard potential. According to the St. Louis District, Corps of Engineers failure would threaten the life and property of three families downstream of the dam and would potentially cause appreciable damage to two road crossings and one large building within the estimated damage zone which extends 3 miles downstream of the dam.

Our inspection and evaluation indicates the spillway does meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The criteria for a spillway on a small dam in the high hazard category is that the spillway pass 50 to 100 percent of the probable maximum flood without overtopping the dam. The spillway will not pass the probable maximum flood without overtopping but will pass 70 percent of the probable maximum flood. Considering the small volume of water impounded and the large flood plain downstream, one-half the probable maximum flood is the appropriate spillway design flood.

Deficiencies visually observed by the inspection team were erosion, seepage at and undercutting of the concrete chute apron, and the presence of one small tree on the downstream embankment slope.

There were no observed deficiencies or conditions existing at the time of the inspection which indicated an immediate safety hazard. Future corrective action and regular maintenance will be required to correct or control the described deficiencies. A detailed report discussing each of these deficiencies is attached.

Paul R. Zaman, PE
Illinois 62-29261

Bruce A. Ainsworth, PE
Missouri E-18023

Harry L. Callahan, Partner
Black & Veatch

OVERVIEW OF LAKE AND DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NO NAME 791 DAM (COVES LAKE DAM)

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APPENDIX

Appendix A - Hydrologic Computations

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the District Engineer of the St. Louis District, Corps of Engineers, directed that a safety inspection of the No Name 791 Dam be made. Throughout the remainder of this report, No Name 791 will be referred to by its common name, Coves Lake.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an earth structure located in the valley of a tributary to Line Creek in southeastern Platte County, Missouri (Plate 1). A roadway has been constructed across the top of the dam. Two 8-inch gravity sewer lines pass through the foundation beneath the dam at elevations below normal pool. The sewer lines are encased in concrete beneath the dam and have concrete collars on each side of the encasement. Topography of the contributing watershed is characterized by rolling hills. The watershed is primarily comprised of residential areas. Topography in the vicinity of the dam is shown on Plate 2.

(2) A spillway is located near the left abutment. It is comprised of three box culverts over which the road was constructed. An approach channel with a concrete floor directs flow to the culverts which discharge to a concrete exit apron and chute. The existing concrete chute has steep side slopes. The concrete chute follows the downstream slope of the dam to the toe, at which point it enters the existing streambed.

(3) Pertinent physical data are given in paragraph 1.3.

b. Location. The dam is located in southeast Platte County, Missouri, as indicated on Plate 1. The lake formed by the dam is shown on the United States Geological Survey 7.5 minute series quadrangle map for Parkville, Missouri - Kansas in Section 8 of T51N, R33W.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Based on these criteria, the dam and impoundment are in the small size category.

d. Hazard Classification. The hazard classification for this dam is as follows: The Cove Lake Dam has a high hazard potential, meaning that the dam is located where failure may cause loss of life, and serious damage to homes, extensive agricultural, industrial and commercial facilities, and to important public utilities, main highways or railroads. For the Cove Lake Dam the flood damage zone extends downstream for 3 miles. Within the first 1/2 mile downstream of the dam are three houses, one large building, and two road crosssings.

e. Ownership. The dam is owned by The Coves Homes Association, 8221 NW Overland Drive, Kansas City, Missouri 64151.

f. Purpose of Dam. The dam forms an 8 3/4 acre recreational lake.

g. Design and Construction History. Data relating to the design and construction were obtained from the Engineering Department of the City of Kansas City, Missouri.

h. Normal Operating Procedure. Normal rainfall, runoff, transpiration, and evaporation all combine to maintain a relatively stable water surface elevation.

1.3 PERTINENT DATA

a. Drainage Area - 95 acres

b. Discharge at Damsite.

(1) Normal discharge at the damsite is through the uncontrolled spillway.

(2) Estimated spillway capacity at maximum pool elevation - 350 cfs.

c. Elevation (Feet Above M.S.L.).

(1) Top of dam - 981.8 ± (see Plate 3)

(2) Spillway crest - 976.8 (ungated)

(3) Streambed at centerline of dam - 947 ±

(4) Maximum tailwater - unknown.

d. Reservoir. length of maximum pool - 950 feet ±

e. Storage (Acre-feet).

(1) Normal pool at spillway crest - 80 (from E. I. Myers design study)

(2) Top of dam - 150

(3) Design surcharge - not available

f. Reservoir Surface (Acres).

(1) Top of dam - 15

(2) Spillway crest - 8 3/4 (from E. I. Myers design study)

g. Dam.

(1) Type - earth embankment

(2) Length - 785 feet

(3) Height - 37 ± feet

(4) Top width - 50 feet

(5) Side Slopes - 1v to 3h (see Plate 4)

(6) Zoning - impervious and random fill (see Plate 4)

(7) Impervious Core - compacted clay (see Plate 4)

(8) Cutoff - 12 feet bottom width, 10-14 feet deep core trench (see Plate 4)

(9) Grout curtain - unknown

h. Diversion and Regulating Tunnel - none.

i. Spillway.

(1) Type - chute.

(2) Width of Culvert - 4.5 feet each, 13.5 feet total.

(3) Crest Elevation - 976.8 feet m.s.l.

(4) Gates - none

(5) Upstream Channel - Concrete apron with wing walls on both sides.

(6) Downstream Channel - Concrete apron to concrete chute that follows the downstream face of the dam to the natural streambed.

j. Regulating Outlets - None.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

Design data included the boring logs and pressure tests performed by Layne-Western Company, a detailed study of the boring logs and pressure tests and of the hydrology and hydraulics of the proposed spillway by E. I. Myers, Consulting Engineer, and as-built drawings. The files of E. I. Myers are currently in the custody of Williamson Engineering and Surveying, St. Joseph, Missouri.

2.2 CONSTRUCTION

The dam was constructed in 1969.

2.3 OPERATION

The maximum recorded loading on the dam is unknown.

2.4 EVALUATION

a. Availability. Engineering data was readily available.

b. Adequacy. The engineering data available did not all conform to the criteria established by the guidelines. A seepage analysis had been performed for the dam and recommended design implementations were followed in construction. Stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These stability analyses should be performed for appropriate loading conditions (including earthquake loads) and be made a matter of record.

c. Validity. The engineering data available were valid except for the estimates of discharge through the spillway culverts at low flows. The culvert discharge at maximum pool elevation was correct.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of Coves Lake Dam was made on 31 August 1978. The inspection team included professional engineers with experience in dam design and construction, hydrology - hydraulic engineering, and structural engineering. Specific observations are discussed below. No observations were made of the condition of the upstream face of the dam below the pool elevation at the time of the inspection.

b. Dam. The inspection team observed the following items at the dam. The downstream slope of the dam is 3h to 1v and is sparsely covered with grass with some erosion observed. The erosion consists of gulleys 8 inches deep up to 16 inches deep. The riprap on the upstream face is adequate. A road crosses the dam. Located near the center of the dam is a drain that drains stormwater from the road on the dam into the lake. Near the left abutment there is another larger stormwater drain entering the lake. Some erosion has occurred around the drain. From examining the boring logs taken near the dam axis, the topsoil is underlain with 10 to 20 feet of sandstone, under which there are layers of limestone and shale. No information on laboratory results, jointing, solution activity, and bedding for the material beneath the dam and in the immediate vicinity was available for review. E. I. Myers in his report located a fault in the north abutment between two limestone ledges. No unstable conditions were observed along this fault area at the time of the inspection.

c. Appurtenant Structures. The spillway is located approximately 70 feet from the left abutment. It consists of a triple 4.5 feet by 3.0 feet reinforced concrete box culvert. A concrete approach apron leads into the triple box culvert and the outlet is also a concrete apron. The concrete exit apron drains onto a concrete chute that follows the downstream slope of the dam down to the dam toe. At the toe of the dam the chute intersects a flat concrete slab approximately 1 foot thick. Beyond the flat slab is the natural streambed, which consists of a rocky channel with gentle sloping sides that are covered with grass and a few trees. Contact between the edge of the spillway chute and the abutment is generally intact, the exception is washed ditches caused by natural abutment runoff. About 75 feet downstream of the dam centerline, the chute apron is undermined and eroded approximately 18 inches deep. Minor seepage was observed along the left side of the spillway chute approximately 8 feet from the bottom end of the chute.

d. Reservoir Area. No slides or excessive erosion due to wave action were observed along the shore of the reservoir.

e. Downstream Channel. Moderate vegetation along the banks and mild channel slopes typical of streams in the area characterize the channel downstream of the spillway chute.

3.2 EVALUATION

None of the conditions observed are significant enough to indicate a need for immediate remedial action, however, if erosion of the spillway discharge chute along the abutment and erosion of the downstream side of the dam continue unchecked, a serious potential for failure will develop.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The pool is primarily controlled by rainfall, runoff, evaporation, and capacity of the spillway.

4.2 MAINTENANCE OF DAM

Maintenance performed was unknown.

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities exist at this structure.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

The inspection team is not aware of any existing warning system for this dam.

4.5 EVALUATION

Existing erosion at the edge of the spillway chute and on the downstream side of the dam increases the potential for failure and warrant regular monitoring and control.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. As-built drawings of the dam showed the location, elevation, and design of the spillway. The study by E. I. Myers contained a discharge rating curve for the spillway culverts; however, the discharges for depths less than 3 feet were incorrect and were not used in this inspection.

b. Experience Data. The drainage area was developed from USGS Parkville Quadrangle Map. The spillway and dam layouts are from the as-built drawings.

c. Visual Observations.

(1) The concrete box culvert and the concrete approach and discharge aprons of the spillway are in good condition. The concrete chute is in good condition with minor undermining as discussed in paragraph 3.1.c.

(2) Spillway discharges will not endanger the integrity of the dam.

d. Overtopping Potential. The spillway will pass between 50 to 100 percent of the probable maximum flood, which is the spillway design flood recommended by the guidelines, without overtopping. The probable maximum flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The spillway will pass 70 percent of the probable maximum flood without overtopping. This flood is greater than the 100-year estimated according to the methodology outlined by the USGS in "Technique for Estimating the Magnitude and Frequency of Missouri Floods". According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, a high hazard dam of small size should pass 50 to 100 percent of the probable maximum flood. The portion of the estimated peak discharge of the probable maximum flood overtopping the dam would be 380 cfs of the total discharge from the reservoir of 740 cfs. The estimated duration of overtopping is 1.8 hours.

According to the St. Louis District, Corps of Engineers, the effect from rupture of the dam could extend approximately 3 miles downstream of the dam. There are three inhabited homes, one large building, and two road crossings downstream of the dam which could be severely damaged and lives of the inhabitants could be lost should failure of the dam occur.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visual observations of conditions which affect the structural stability of this dam are discussed in Section 3, paragraph 3.1b.

b. Design and Construction Data. A study of the boring logs and pressure tests for the dam were made by E. I. Myers, Consulting Engineer. The borings and pressure tests were conducted by Layne - Western Co.

Subsurface investigations included eight sample borings. Pressure tests were performed in six of the borings. Detailed logs of these borings and boring locations were supplied.

E. I. Myers in his report states that the borings do not indicate any unstable conditions along the axis of the dam. The borings indicated that a core trench should be excavated having bottom width of 12 feet with one on one side slopes and 10 to 14 feet deep. This core trench was backfilled with compacted clay across the length of the dam. The borings indicated a fault between two limestone ledges in the North abutment. This fault was sealed by drilling a series of 12 inch diameter overlapping holes along the centerline of the dam in the area of the fault. The holes were filled with concrete deposited under water by means of a tremie.

c. Operating Records. No operational records exist.

d. Post Construction Changes. No post construction changes are known to exist.

e. Seismic Stability. The dam is located in Seismic Zone 1 which is a zone of minor seismic risk. A properly designed and constructed earth dam using sound engineering principles and conservatism should pose no serious stability problems during earthquakes in this zone.

The seismic stability of an earth dam is dependent upon a number of factors: embankment and foundation material classification and shear strengths; abutment materials, conditions, and strength; embankment zoning; and embankment geometry. Adequte description of embankment design parameters, foundation and abutment conditions, or static stability analyses to assess the seismic stability of this embankment was not available and therefore no inferences will be made regarding the seismic stability. An assessment of the seismic stability should be included as part of the stability analysis required by the guidelines.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. Several items noted during the visual inspection by the inspection team which should be monitored or controlled are the seepage along a small area of the spillway chute, erosion of the downstream face of the dam and along the edges of the spillway chute which in one area has led to slight undermining of the chute, and the presence of a tree on the downstream face of the dam.

b. Adequacy of Information. The conclusions in this report were based on performance history, design data, and visual conditions. The inspection team considers that these data are sufficient to support the conclusions herein. Seepage and stability analyses comparable to the requirements of the Recommended Guidelines for Safety Inspection of Dams were not available, which is considered a deficiency.

c. Urgency. A program should be developed as soon as possible to monitor at regular intervals the deficiencies described in this report. The remedial measures recommended in paragraph 7.2 could be accomplished now or delayed until observations of this monitoring program and/or the recommendation of a qualified engineer indicate the necessity of action. If the safety deficiencies listed in paragraph 7.1a are not corrected, they will continue to deteriorate and lead to a serious potential of failure. Presently, immediate action is not considered necessary.

d. Necessity for Phase II. The Phase I investigation does not raise any serious questions relating to the safety of the dam, or identify any serious dangers that would require a Phase II investigation.

e. Seismic Stability. This dam is located in Seismic Zone 1. Because stability analyses are not available, the seismic stability of the dam cannot be assessed. An assessment of the seismic stability should be included as part of the stability analyses recommended by the guidelines.

7.2 REMEDIAL MEASURES

a. Alternatives. No alternative measures are recommended.

b. O&M Maintenance and Procedures. The following O&M maintenance and procedures are recommended:

(1) Remove the one small tree on the downstream face of the dam, and keep downstream face clear of trees and shrubs.

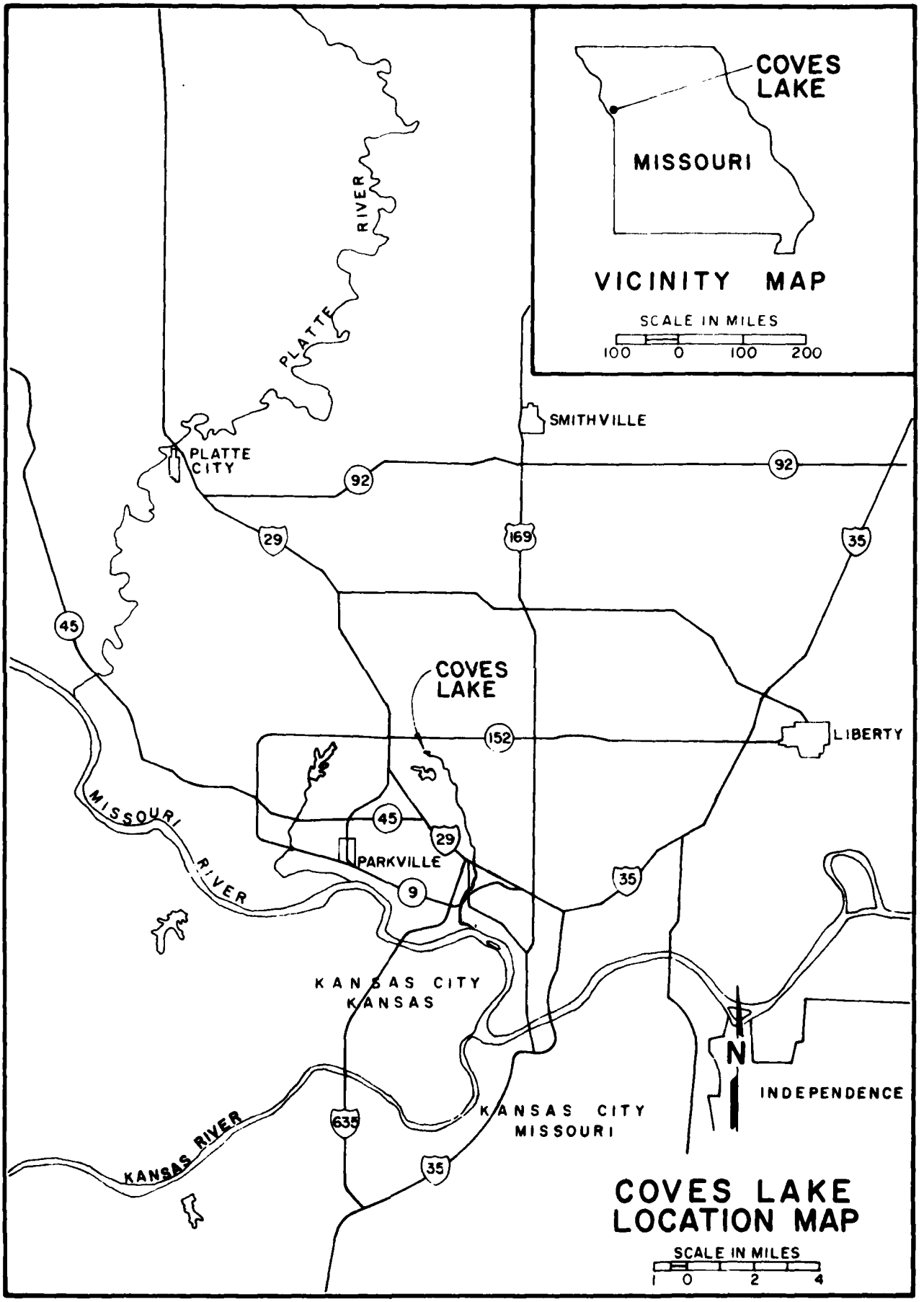
(2) Check the downstream face and the ground adjoining the concrete spillway chute periodically for erosion. Areas of erosion should be repaired. In general the downstream face of the dam has sparse ground

cover and in some areas there is no ground cover and it is around these areas that erosion occurred and the potential for erosion exists.

(3) Periodically check the concrete spillway chute for seepage and undermining. Undermining should be remedied if noticed. If the undermining becomes severe or if increased seepage flow is observed, the dam should be inspected and the condition evaluated by an engineer experienced in design and construction of earthen dams.

(4) A detailed inspection of the dam should be made at least every year by an engineer experienced in design and construction of dams. Once the deficiencies stated in this report have been remedied, less frequent inspections may be made. However, more frequent inspections may be required if additional deficiencies are observed or the severity of the reported deficiencies increases.

(5) Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of dams.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100 0 100 200
PLATTE RIVER
SMITHVILLE
PLATTE CITY
92
29
169
35
45
COVES LAKE
152
LIBERTY
MISSOURI RIVER
PARKVILLE
9
KANSAS CITY KANSAS
N
INDEPENDENCE
KANSAS CITY MISSOURI
635
KANSAS RIVER
COVES LAKE LOCATION MAP
SCALE IN MILES
1 0 2 4

PLATE 1

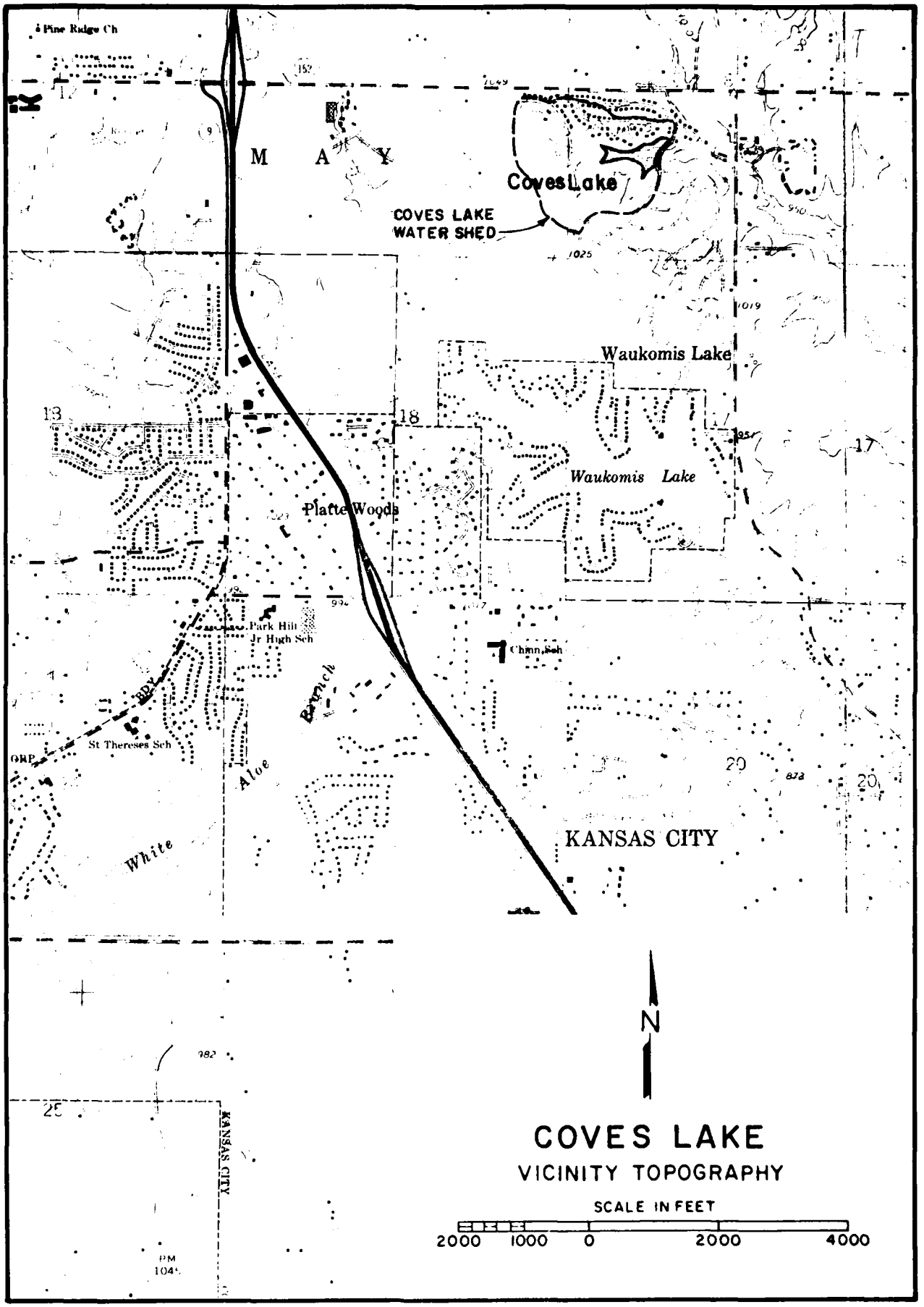
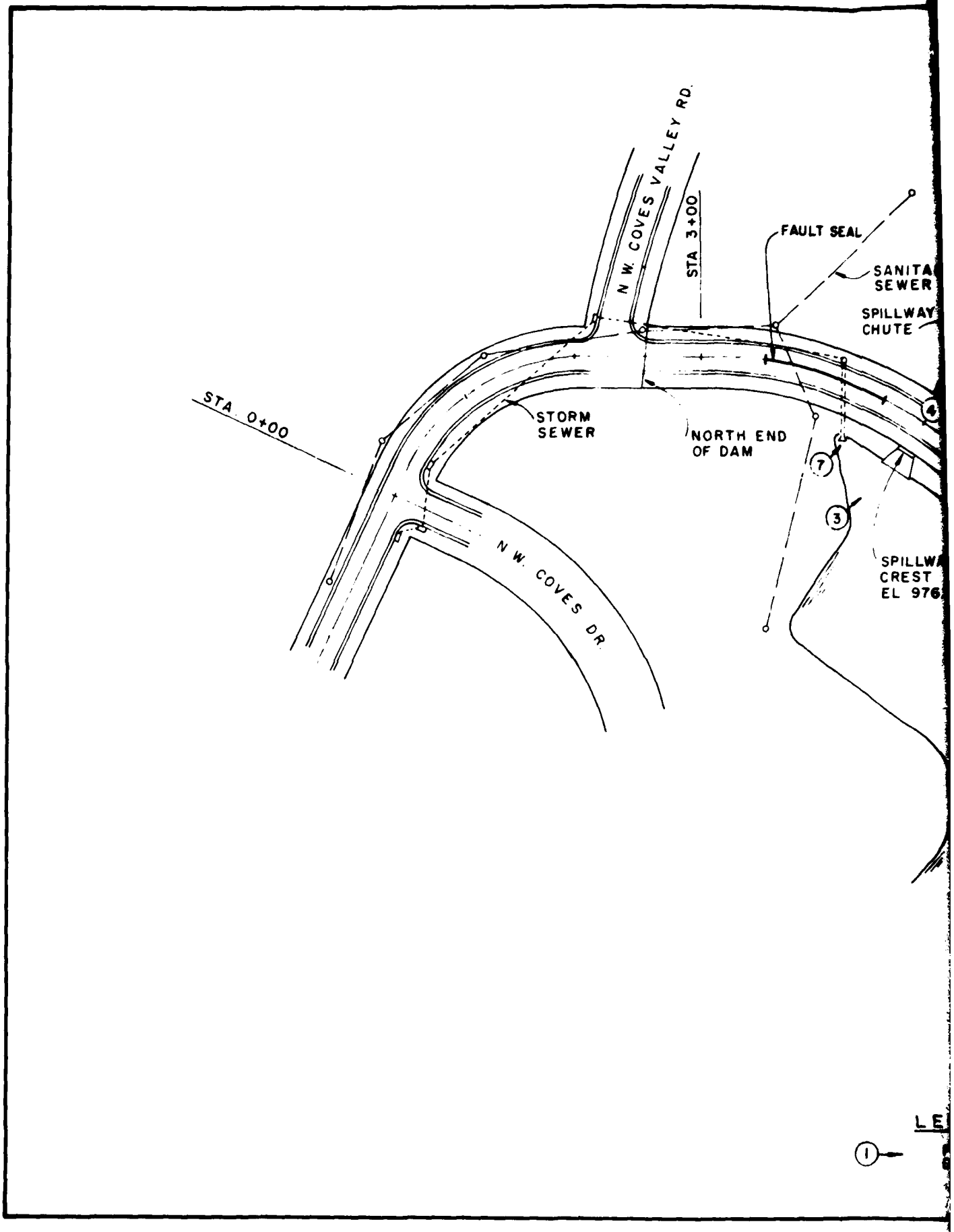
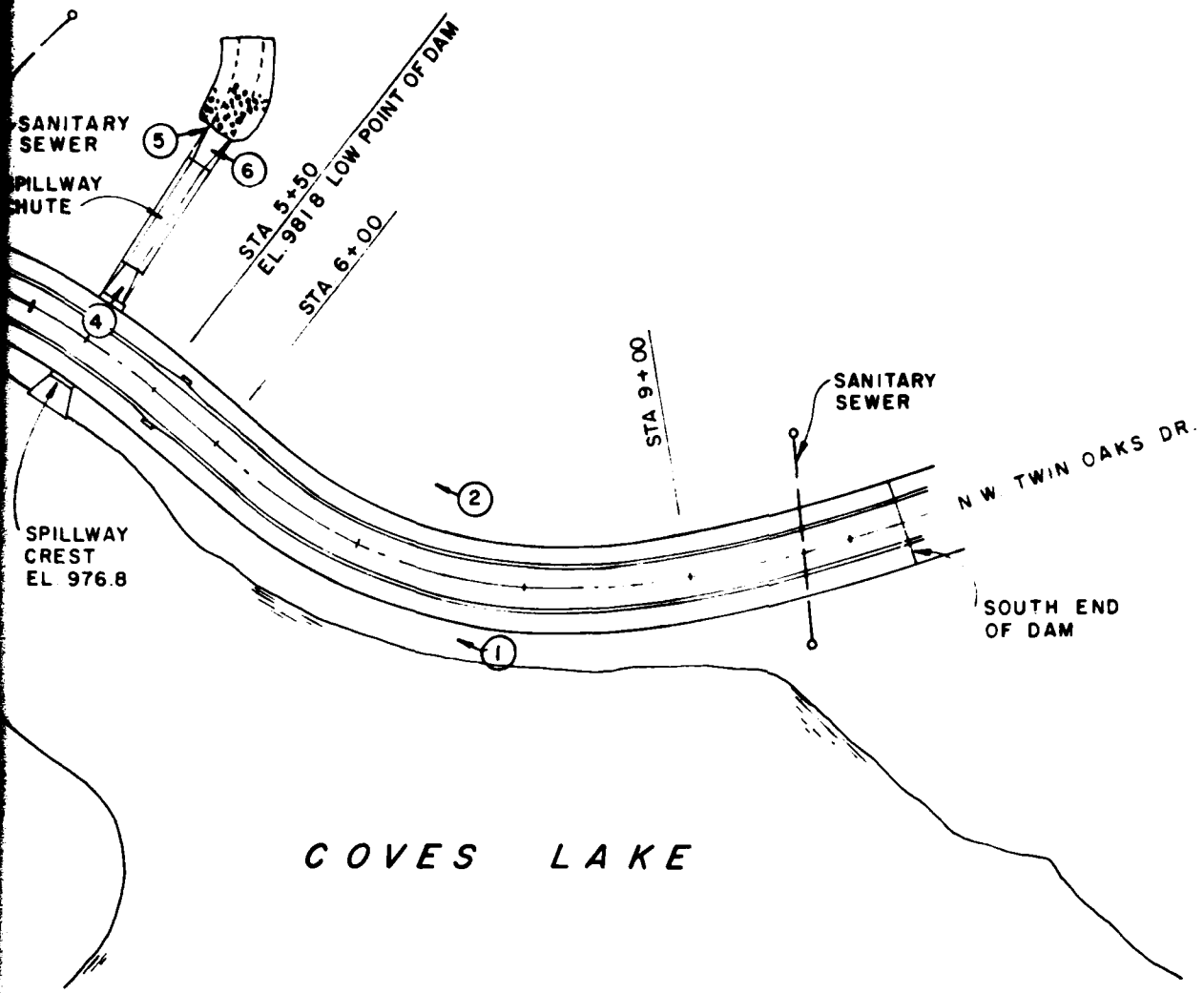

Pine Ridge Ch
M A Y
Coves Lake
COVES LAKE
WATER SHED
Waukomis Lake
Waukomis Lake
Platte Woods
Park Hill
Jr High Sch
Chinn Sch
St Thereses Sch
Alve
Branch
White
KANSAS CITY
KANSAS CITY
N
COVES LAKE
VICINITY TOPOGRAPHY
SCALE IN FEET
2000 1000 0 2000 4000

PLATE 2


N W. COVES VALLEY RD.
STA 3+00
FAULT SEAL
SANITA
SEWER
SPILLWAY
CHUTE
STA 0+00
STORM
SEWER
NORTH END
OF DAM
N W. COVES DR
SPILLWA
CREST
EL 976
4
7
3
LE
1



N

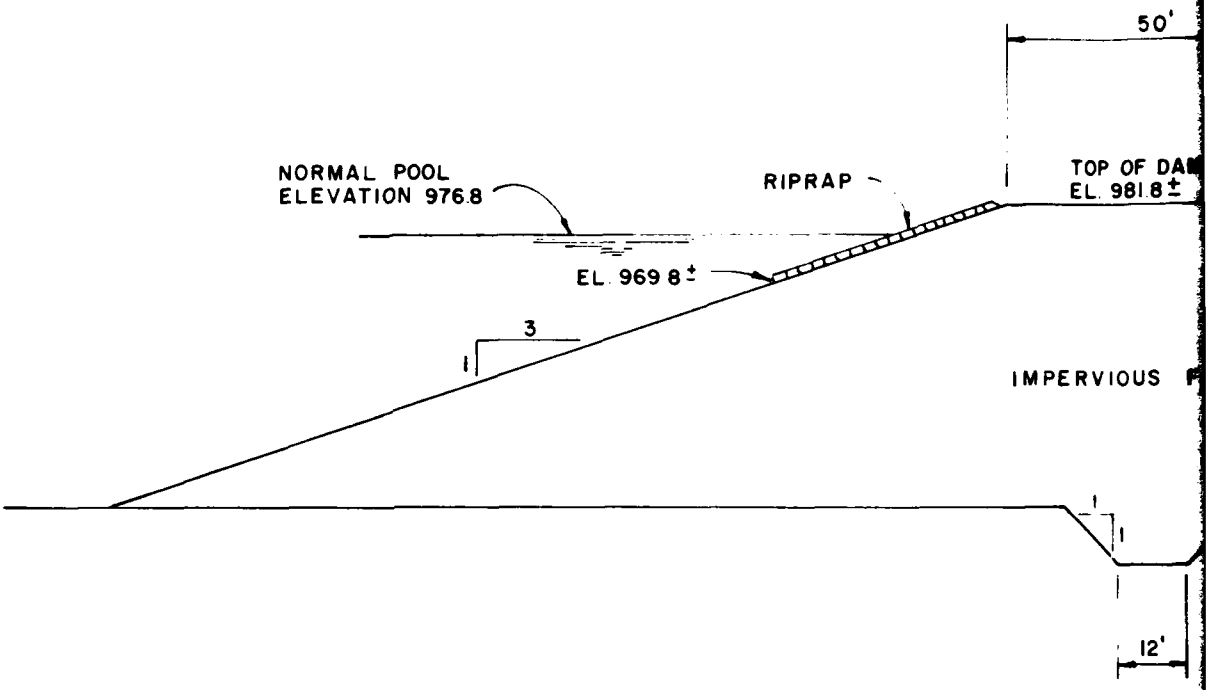
LEGEND

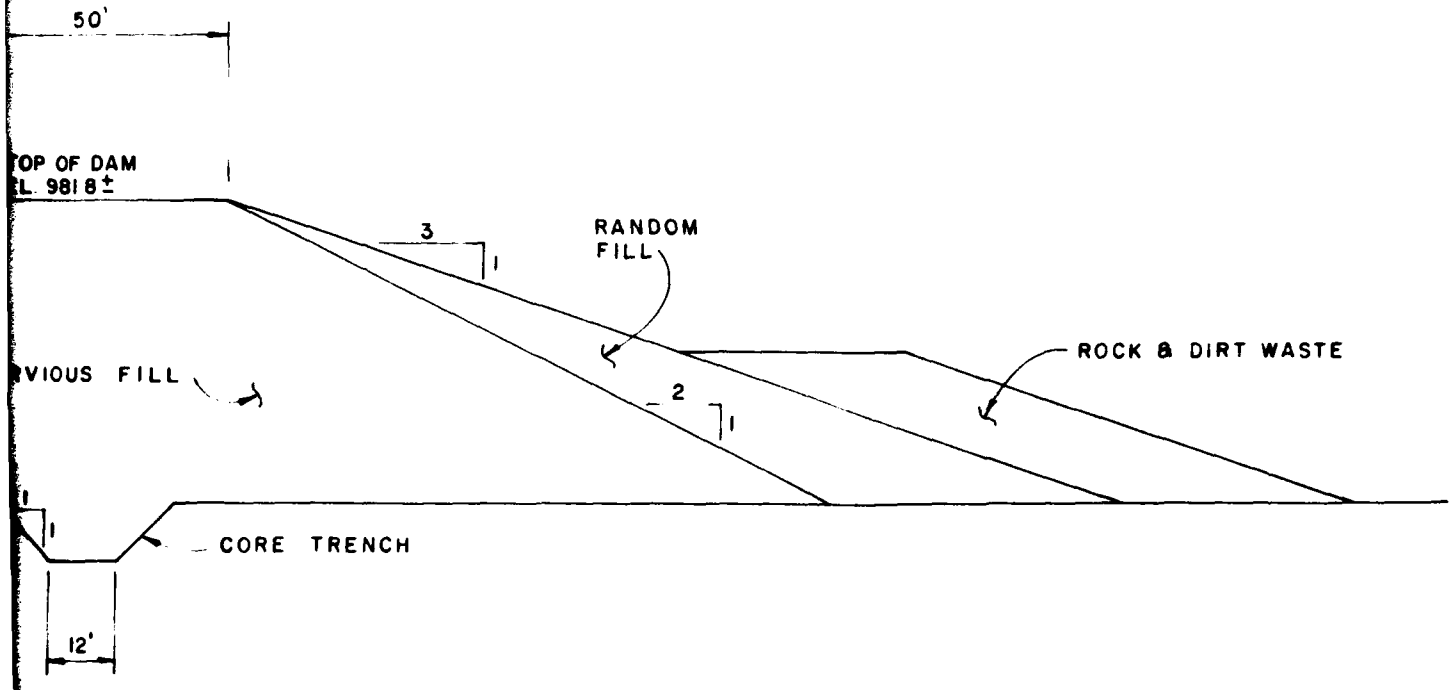
PHOTOGRAPH LOCATION AND DIRECTION

COVES LAKE PLAN

PLATE 3

1 2

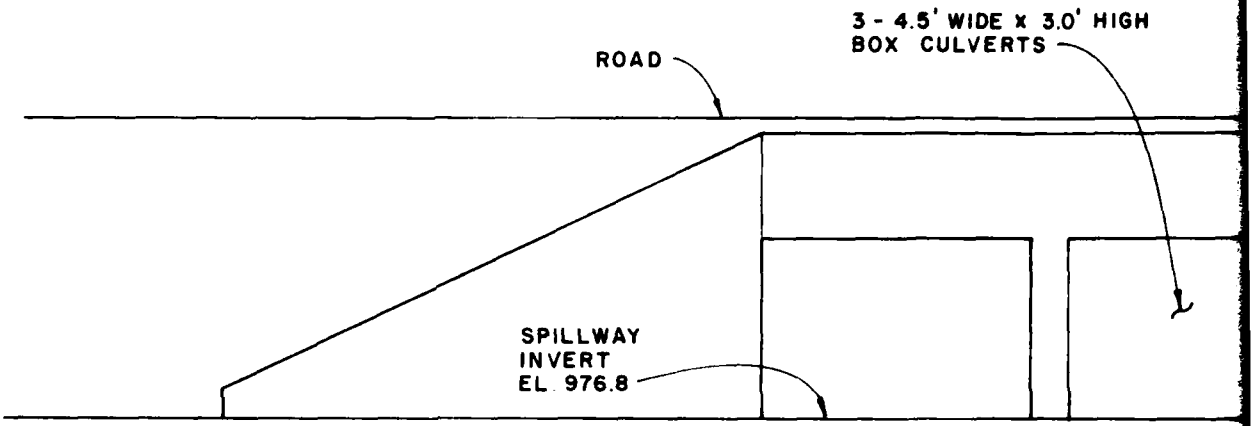

50'
NORMAL POOL
ELEVATION 976.8
RIPRAP
TOP OF DA
EL. 981.8±
EL. 969.8±
3
1
IMPERVIOUS
1
1
12'

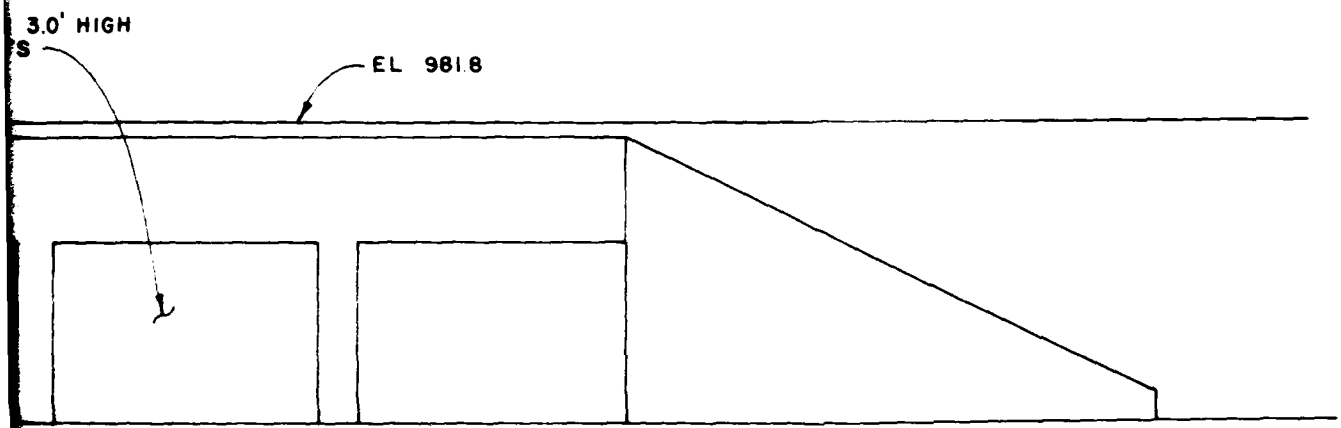


COVES LAKE
TYPICAL SECTION

PLATE 4

1 2


3 - 4.5' WIDE x 3.0' HIGH
BOX CULVERTS
ROAD
SPILLWAY
INVERT
EL. 976.8



COVES LAKE
SPILLWAY ELEVATION

PLATE 5

PHOTO 1: UPSTREAM FACE OF DAM (LOOKING NORTH)

PHOTO 2: DOWNSTREAM FACE OF DAM (LOOKING NORTH)

PHOTO 3: SPILLWAY APPROACH CHANNEL (LOOKING DOWNSTREAM)

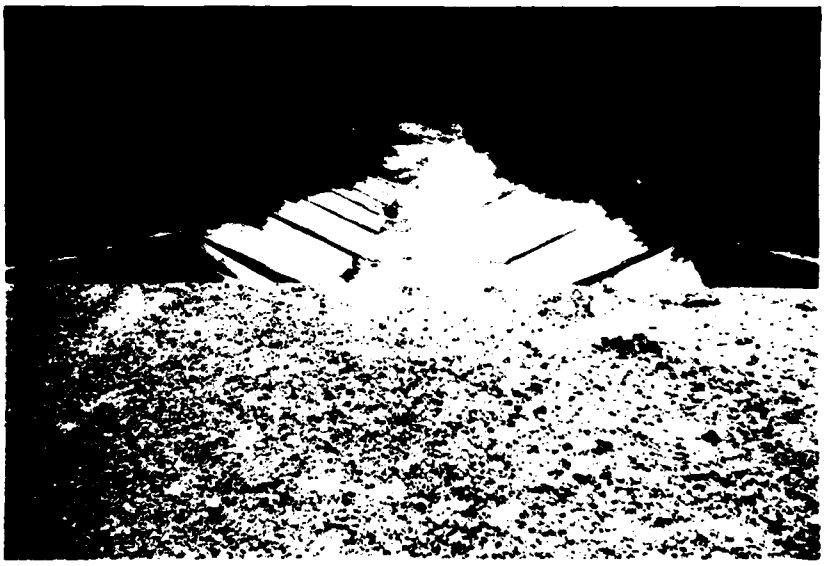


PHOTO 4: SPILLWAY CHUTE (LOOKING DOWNSTREAM)

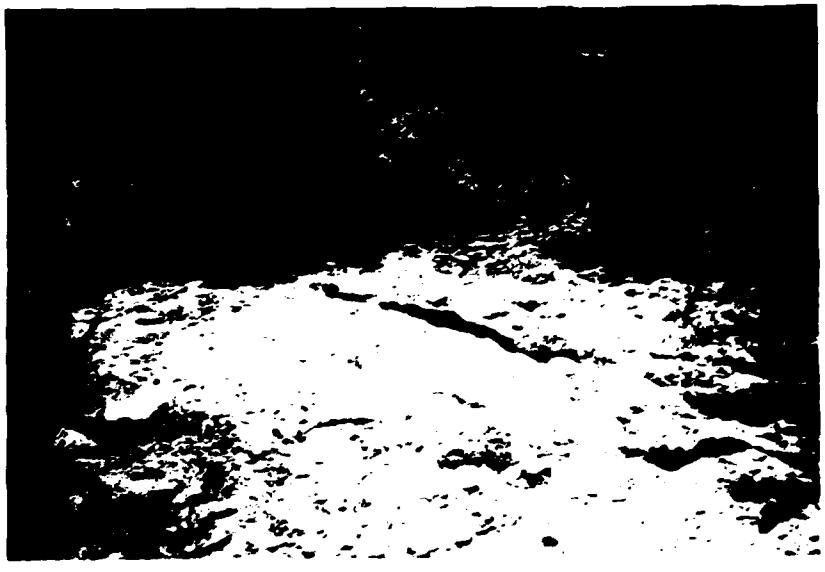


PHOTO 5: SPILLWAY DISCHARGE CHANNEL (LOOKING DOWNSTREAM)

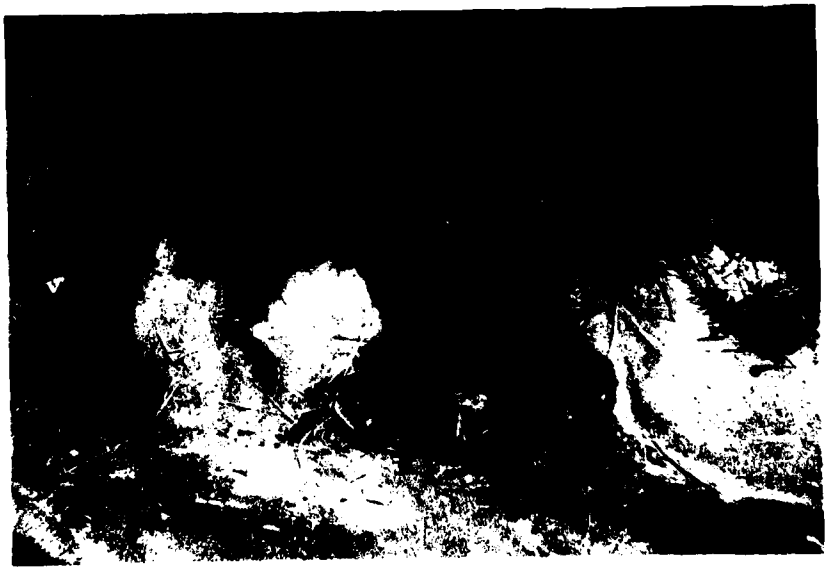


PHOTO 6: SEEPAGE AT SPILLWAY CHUTE APRON

PHOTO 7: STORMWATER DRAIN ON UPSTREAM FACE OF DAM

APPENDIX A

HYDROLOGIC COMPUTATIONS

HYDROLOGIC COMPUTATIONS

1. The Soil Conservation Service (SCS) dimensionless unit hydrograph and HEC-1 (1) were used to develop the inflow hydrograph (see Plate A-1). Hydrologic inputs are as follows:

a. Twenty-four hour, probable maximum precipitation determined from U.S. Weather Bureau Hydrometeorological Report No. 33:

200 square mile, 24 hour rainfall	- 24.4 inches
10 square mile, 6 hour percent of 24 hour 200 square mile rainfall	- 106%
10 square mile, 12 hour percent of 24 hour 200 square mile rainfall	- 122%
10 square mile, 24 hour percent of 24 hour 200 square mile rainfall	- 131%

b. Drainage area = 95 acres.

c. Time of concentration: $Tc = (11.9 \times L^3/H)^{0.385} = 0.1$ hours = 6 minutes

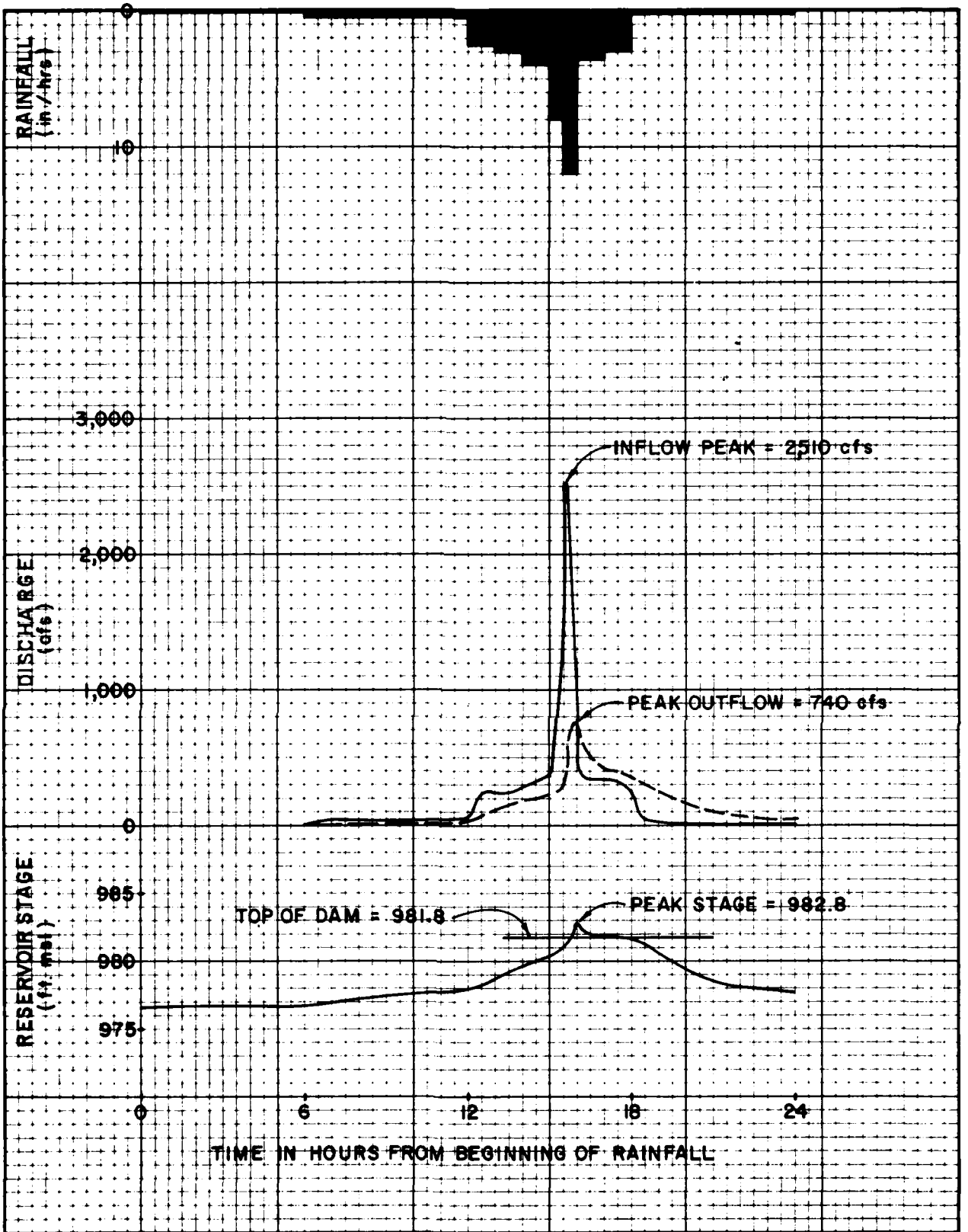
d. Losses were determined in accordance with SCS methods for determining runoff using a curve number of 86 and antecedent moisture condition III.

2. Spillway discharge rates are based on chart 1 for box culverts with inlet control from "Hydraulic Charts for the Selection of Highway Culverts", U.S. Department of Commerce.

3. The elevation-storage relationship above normal pool elevation was constructed by planimetering the area enclosed within each contour above normal pool. The storage between two elevations was computed by multiplying the average of the areas at the two elevations by the elevation difference. The summation of these increments below a given elevation is the storage below that level.

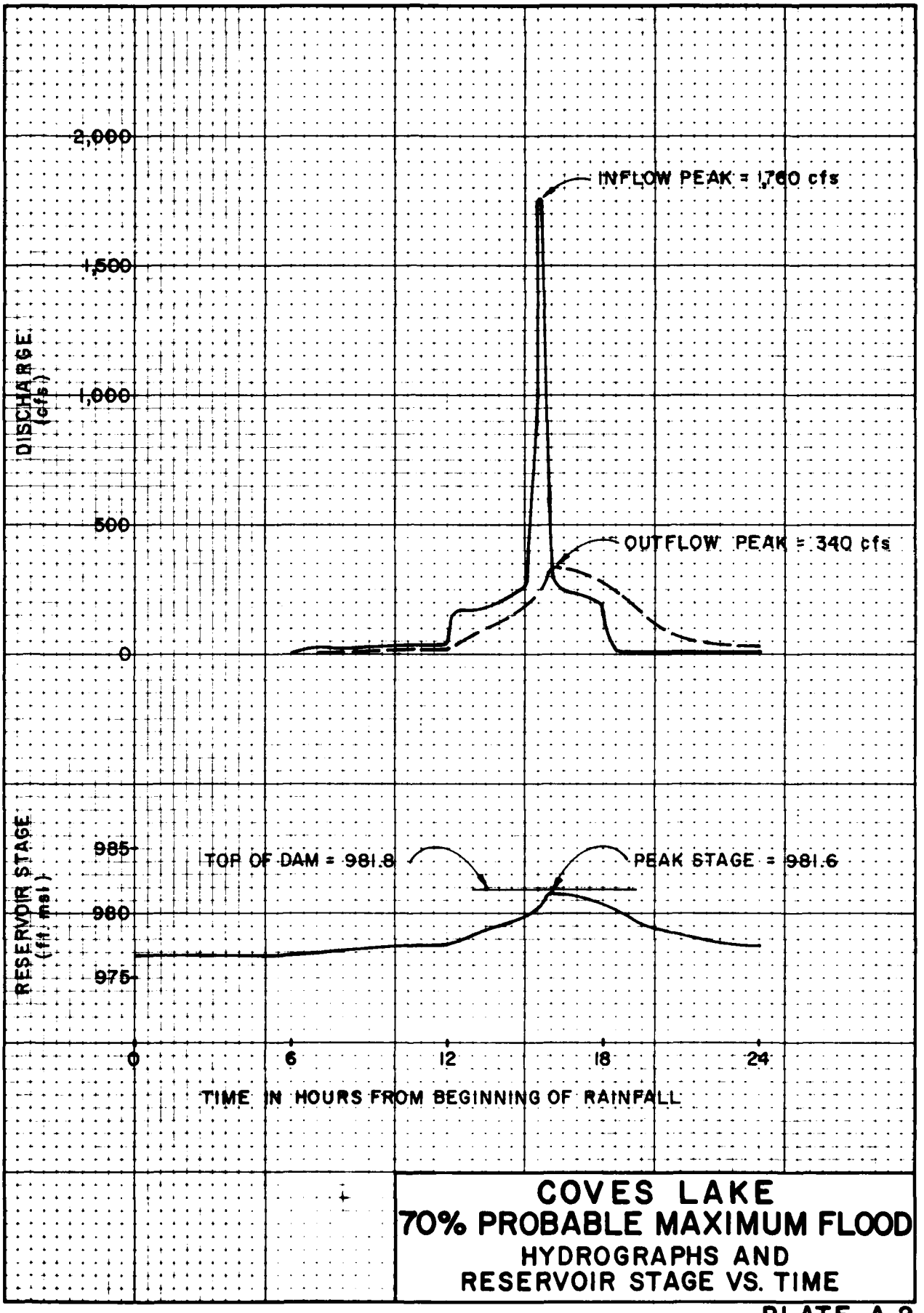
4. Floods are routed through the spillway using HEC-1, with the modified Puls routing method, to determine the capacity of the spillway. Inflow and outflow hydrographs are shown on Plates A-1 and A-2.

(1) U.S. Army Corps of Engineers, Hydrologic Engineering Center, Flood Hydrograph Package (HEC-1) Dam Safety Verson, July, 1978, Davis, California



COVES LAKE
PROBABLE MAXIMUM FLOOD
HYETOGRAPH, HYDROGRAPHS, AND RESERVOIR STAGE VS. TIME

PLATE A-1



COVES LAKE
70% PROBABLE MAXIMUM FLOOD
HYDROGRAPHS AND RESERVOIR STAGE VS. TIME

PLATE A-2


FILME